THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

155/2 **FOOD AND HUMAN NUTRITION 2**

(For Both School and Private Candidates)

Time : 3 Hours **ANSWERS** **Year : 2014**

Instructions

1. This paper consists of sections **A** and **B**.
2. Answer all questions in section **A** and only **two (2)** question from section **B**.
3. Non-programmable calculators may be used.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. You are provided with food samples DD and EE. Carry out the following experiments by following the given procedures.

Experiment I:

(i) Place 3 g of sample DD (finely ground rice flour) in a beaker and add 10 ml of distilled water. Stir well.

(ii) Leave the suspension to settle for 5 minutes. Decant the supernatant and retain the sediment.

(iii) Place a drop of the sediment on a glass slide, stain with iodine solution and observe under a microscope.

Experiment II:

(iv) Put 2 g of sample EE (corn starch) into a clean porcelain dish. Heat it gently until the colour changes.

(v) Allow it to cool and add a few drops of iodine solution. Record observations.

Questions

(a) Draw and describe the microscopic structures observed in Experiment I.

The microscopic observation shows oval or polygonal starch granules with hilum in the centre. They may appear bluish-black when stained with iodine, confirming the presence of starch grains in rice flour.

(b) Explain the significance of the colour changes in step (iii).

The colour change to blue-black indicates that the sediment contains starch. The iodine reacts with the amylose portion of starch, forming a starch-iodine complex responsible for the colour.

(c) Identify the reaction that took place in Experiment II, step (iv).

The reaction is dextrinization, where starch is broken down by dry heating into shorter-chain carbohydrates called dextrins, resulting in a brownish colour.

(d) Why does the iodine test give a different result before and after heating in Experiment II?

Before heating, starch has intact amylose helices that bind with iodine, producing a blue-black colour. After heating, the starch molecules break down into dextrins, which do not form the same complex with iodine, hence a reddish-brown colour appears instead of blue-black.

(e) State two uses of starch modification in food industries.

Modified starch is used as a thickening agent in soups, sauces and puddings. It is also used in the baking industry to improve texture and stability of products.

2. You are provided with a fresh egg labelled sample FF. Separate the egg white from the yolk and perform the following procedures:

Experiment I:

(i) Place 2 ml of egg white in a test tube. Add 1 ml of 10% sodium hydroxide solution and then add 3 drops of 1% copper sulphate solution. Record your observations.

(ii) Heat another 2 ml of egg white in boiling water for 5 minutes. Record observations.

Experiment II:

(iii) Place a small portion of egg yolk in a porcelain dish. Heat gently until brown fumes appear. Record the colour and smell.

Questions

(a) State the food nutrient tested in step (i) and explain the principle of the test.

The nutrient tested is protein. The Biuret test principle is based on the reaction of copper ions with peptide bonds under alkaline conditions, producing a violet or purple colour.

(b) What property of proteins is demonstrated in step (ii)?

The property demonstrated is denaturation and coagulation. Heat breaks hydrogen and weak bonds in protein structure, causing the proteins to unfold and aggregate into a solid white mass.

(c) What does step (iii) demonstrate about egg yolk composition?

Heating egg yolk until brown fumes appear demonstrates the presence of lipids and proteins. The brown fumes and burnt smell result from decomposition of fats and proteins in the yolk.

(d) Justify the use of eggs as functional ingredients in baking and food preparation.

Eggs are used because proteins in egg whites coagulate to provide structure and stability in cakes and custards. Egg yolks contain lecithin, a natural emulsifier, which helps mix fats and water. Eggs also contribute to aeration, colour, and flavour, making them valuable in food preparation.

3. You are provided with samples GG (baker's yeast), HH (glucose solution) and lime water. Perform the following:

Experiment I:

(i) Place 50 ml of sample HH into a conical flask. Add 3 g of sample GG and shake well.

(ii) Fit the flask with a cork and connect it to a delivery tube dipped into lime water.

(iii) Leave for 15 minutes and record the changes in lime water.

(iv) Smell the contents of the flask before and after 15 minutes.

Experiment II:

(v) Repeat steps (i)–(iii) but place the flask in hot water at 70 °C.

Questions

(a) Identify the gas evolved in Experiment I, step (iii).

The gas evolved is carbon dioxide, which turns lime water milky.

(b) Write a balanced equation for the reaction taking place in Experiment I.

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

(Glucose → Ethanol + Carbon dioxide)

(c) Explain the effect of temperature observed in Experiment II.

At 70 °C, yeast enzymes are denatured, stopping fermentation. As a result, no carbon dioxide is produced, and lime water remains clear.

(d) State two industrial applications of the process demonstrated in Experiment I.

Fermentation is used in the production of alcoholic beverages like beer and wine. It is also applied in baking, where carbon dioxide helps dough to rise.

(e) Briefly explain the importance of yeast in bread making.

Yeast ferments sugars in the dough, producing carbon dioxide that causes the dough to expand and rise. This results in a soft, porous bread texture. Yeast also contributes to flavour development.